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TESTIMONIALS

IN FAVOR OF THE PLAN OF

HORACE H. DAY,

OF NEW YORK,

5 OCT 19
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FOR THE

CHEAP TRANSIT OF LOADED VESSELS

BETWEEN NAVIGABLE WATERS,

BY MEANS OF

SHIP CANALS, WITH INCLINED PLANES;

ESPECIALLY APPLICABLE TO THE

Proposed Work Around Niagara Falls.

NEW YORK:
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1866.

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SHIP CANALS

WITH

INCLINED PLANES.

That the following testimonials may be fully understood, it is only necessary to say that my plan combines a canal with inclined planes, and is entirely new, as applicable to the transportation of loaded vessels of the larger class.

I have presented the plan in detail to the Boards of Trade of many of our great commercial cities, and some of the most distinguished Engineers of the country have been consulted with reference to the feasibility and practicability of the plan proposed. Neither time, labor, nor expense has been spared in my endeavors to obtain the testimony of persons most largely interested in the commercial prosperity of the country, and of Engineers selected by them.

It will be observed that the testimonials which follow relate principally to a work which will connect the navigable waters of Lakes Erie and Ontario, around Niagara Falls; the same plan, with less difficulties to overcome, may be executed in the completion of a great highway for loaded vessels from the waters of the Western Lakes to those of the Atlantic.

It is not necessary for me to mention the many places in the world where the interests of commerce would be advanced by the use of the new combination; our own country presents a sufficiently wide field of observation, and many points where the invention may be profitably used will at once suggest themselves to the reader.

HORACE H. DAY.

New York, Jan., 1866.

TESTIMONIALS.

(From Chicago Board of Trade.)

BOARD OF TRADE OF THE CITY OF CHICAGO,
Secretary's Office, Chicago, January 6th, 1866.

The following is the report of a Committee appointed by the Directors of the Board of Trade of the City of Chicago, to investigate the plan proposed by Horace H. Day, Esq., to effect direct communication with vessels between the Upper and the Lower Lakes.

"To the President and Directors
of the Board of Trade of the City of Chicago:

"Your Committee to whom was referred the plan of passing Niagara Falls "by means of a Canal and Inclined Planes, as proposed by H. H. Day, Esq., "would respectfully report:

"That in their opinion the plan is entirely feasible, and, in view of the "great saving of time and expense to the commerce of the country, worthy of "the most favorable considerations.

"With reference to the questions of a mechanical nature that will arise "with regard to the mode of applying the power requisite to transport vessels "over the Plane, and the forms of structure necessary for the purpose, we re- "commend that the opinions of the best mechanical engineers in the country "be obtained on the subject."

CHICAGO, Jan. 5, 1865.

I. Y. MUNN,
JULIAN S. RUMSEY,
C. T. WHEELER,
Committee.

E. S. CHESBROUGH,
R. B. MASON,
WM. GOODING,
Engineers.

The foregoing report was submitted to the full Board, on 'Change, this day, and upon vote was unanimously approved.

CHARLES RANDOLPH,
President.

JOHN F. BEATTY,
Secretary.

(*From Cleveland Board of Trade.*)

BOARD OF TRADE ROOMS.,
Cleveland, January 13th, 1866.

HORACE H. DAY, Esq.:

Dear Sir,—I have the pleasure of announcing the fact, that the accompanying resolutions reported by the Committee appointed to examine your plan were unanimously adopted by this Board at its meeting this day.

I am, yours respectfully,
J. C. SAGE,
Secretary.

Resolved, That the importance of ship transit around the Falls of Niagara, on our own territory, cannot be over estimated, and should be a national work commenced and completed as soon as practicable.

Resolved, That the plan of overcoming the ascent or descent of such transit by means of inclined planes, with vessels afloat—on the general principle now before us by Mr. Horace H. Day, is in our judgment practicable, but we are not prepared to decide at the present time upon the economy or nett advantages of such mode, as compared with transit by lockage, although it presents many features entitling it to favorable consideration and further thorough examination.

P. CHAMBERLAIN,
A. STONE, Jr.
H. B. TUTTLE.
J. H. CLARK,
GEO. H. BURT,
J. H. SERGEANT,
R. K. WINSLOW,
S. S. COE,
E. M. PECK,
} *Committee.*

Resolved, That a committee of three members of the Board be appointed, of whom the President shall be its Chairman, to confer with like committees from other Boards of Trade and Chambers of Commerce, on the subject embraced in the foregoing resolutions.

(*From Detroit Board of Trade.*)

BOARD OF TRADE ROOMS,
DETROIT, MICH., January 3rd, 1866.

H. H. DAY, Esq.:

Dear Sir,—The following report of the Committee appointed to consider the matter was this day adopted by this Board:

"The committee to whom was submitted the plan of Mr. Horace H. Day, "of New York, for cheapening the transit, respectfully report: The com- "mittee has heard Mr. Day's explanation of the details of his plan, and "examined the testimonials of engineers submitted by him, and have also "obtained the opinions of two eminent engineers in this vicinity, whose "opinions we submit in writing; the judgment of your committee is, that "Mr. Day's invention will work a most important revolution in the means of "transportation, and especially so between the Northern Lakes and the Sea- "board, and at the same time lessen the cost very materially.

"The invention contemplates such a system of Canal structure that no "locks are required, and commerce is conducted without passing water from "one level to another, as ordinarily used in canal navigation; thus lessening "the first cost of construction, and adapting them to any desirable depth of "water and profitable navigation. In passing ships around Niagara Falls, "where this system seems applicable, a Canal to be built one hundred feet "wide and of such depth as to pass vessels drawing fourteen feet of water, "beginning at Schlosser's, about three miles above the Cataract, extending a "distance of about six miles to the brow of the hill at Lewiston, where ships "are raised out of the canal into iron tanks filled with water, in which, while "floating they are passed on inclined planes so constructed that one vessel "ascends as the other descends from the level of the water above the Falls to "that of Lake Ontario in a few minutes, and with entire safety to ship and "cargo. The operation is very simple, and in the judgment of your commit- "tee, entirely feasible.

"B. G. Stimson,
"*Chairman.*"

The following resolutions were adopted by the Board after some explanatory remarks by Mr. Day:

Resolved, That the Board of Trade of Detroit have heard Mr. Day explanatory of his system of transit and the benefits to result therefrom, with great satisfaction, and take pleasure in tendering to him its cordial approval and assurance of cooperation in his efforts to develop its use.

Resolved, That in view of the great importance of this matter, a Committee be appointed to confer with other Boards of Trade, with a view to such joint action as shall give the country the immediate benefit of its adoption and use, not only at Niagara Falls, but also between Lake Ontario and the Atlantic Ocean; provided it is considered the most expedient plan.

Resolved, That a copy of these proceedings be forwarded to our Senators and Representatives in Congress, with a request that they will give the subject such attention and direction as its great importance demands.

BOARD OF TRADE ROOMS, DETROIT, Jan. 3, 1866.

We hereby certify that the accompanying report and resolutions were unanimously adopted by the Board of Trade of the City of Detroit this day of

Approved by

JOSEPH ASPINALL,
President.

RAY. HADDOCK,
[Seal] *Secretary.*

(*Toledo Board of Trade.*)

Resolutions adopted by Toledo Board of Trade, January, 1866:

Resolved, That this Board have listened with interest to the exposition by H. H. Day, Esq., of his novel method of transferring vessels from Erie and Ontario by means of inclined planes in conjunction with a Ship Canal around the Falls; the saving of time, as compared with the ordinary system of locks, if practicable, commends the plan to the favorable regard of the public, and is worthy of further investigation by such Board of scientific and practical men as Congress may appoint.

Resolved, That the wants of the West, and the East as well, imperatively demand that all practicable new routes that will tend to cheapen the cost of transit should be speedily opened (if possible, by private enterprise) under proper authority from Congress, guarding the public interest against burthensome charges for tolls, &c.; among the enterprises contemplating such objects, a Ship Canal of large capacity around the Falls of Niagara, on American soil, enlists the favorable regard of the people East and West, and has strong claims upon the prompt action of Congress to accomplish it in some way, and by the best possible plan, at an early date.

Resolved, That the project of uniting the upper lakes with Lake Ontario by the plan under consideration, designed especially to benefit the producing States of the West and the manufacturing and consuming States of the East, as well as to promote the export trade in food products abroad, embraces in its expected benefits so many of the States of the Union as to constitute it an eminently national work, worthy the first consideration by statesmen of all sections, and one that may properly share liberally in any appropriations of lands or money made to promote the internal and external commerce of the country.

Resolved, That this Board will co operate with the people and business associations, East and West, in all reasonable efforts to promote the internal commerce of the country, in the removal of all obstacles standing in the way of the cheapest possible transit of property from one section of country to other sections, and we respectfully urge upon the Congress of the United States that this great subject is entitled to the gravest consideration.

Resolved, That a committee, consisting of the President of the Board as chairman, and Messrs. D. B. Smith and F. J. King, be appointed to confer with like committees from other Boards of Trade and Chambers of Commerce on the subjects embraced in the foregoing resolutions.

The following resolution was passed unanimously by the Transportation Committee, of the Boston Board of Trade, Dec. 28th, 1865, after hearing my statement, concerning a ship canal with inclined planes around Niagara Falls.

Resolved, That the thanks of the Transportation Committee of the Boston Board of Trade be and they are, hereby tendered to Mr. Day for the able and interesting presentation he has made on the subject of inclined planes as a substitute for lockage, on the proposed ship canal around the Falls of Niagara, and that Mr. Day may rest assured that the committee will give such consideration to the merits of the question as its great importance demands.

New York, March 27, 1866.

H. H. Day:

Dear Sir,—I have, at your request, visited Niagara, and examined the ground upon which it is proposed to build the Niagara Ship Canal, and made measurements for an inclined plane, and for an estimate of cost of the whole work.

The Canal will be between five and six miles in length, from Schlosser to near the lake ridge, at the foot of which is situated the village of Lewiston. The descent at this point from the level of the Canal to the Niagara River is 320 feet, which it is proposed to overcome by a railway plane or planes of an uniform inclination adapted to the passage of lake vessels and their cargoes.

The plane, as surveyed, is 2¼ miles in length, having an inclination of 132 feet per mile, but it may be varied from this to 100 or 150 feet per mile without very materially altering the cost, which, at present prices for labor and materials for a canal having fourteen feet depth of water and 130 feet width of surface, will be about ten millions of dollars.

The ground is admirably adapted for the use of the plane, which I consider indispensable to the utility and success of the work. In constructing it, no difficulties of a serious character will be encountered beyond what will be met with in the construction of locks. Upon the line, as surveyed, the greatest depth of excavation is 85 feet, and of embankment about 96 feet.

Edwin F. Johnson,
Civil Engineer,
Middletown, Conn.

(From William F. Parrott, Esq., Civil Engineer.)

Boston, Dec. 26th, 1865.

Horace H. Day, Esq.:

Dear Sir,—I have examined your project for transferring loaded ships from one level in a canal to another. In my opinion there are no practical difficulties in carrying out your plan; indeed, it is only combining for this special purpose, well known devices in machinery which are in every day use.

The plan is on a much larger scale than we are now used to, but this requires only that the parts of the machine should be of corresponding size and strength. The object you have in view will fully justify this great project, as there is not in my judgment any internal improvement so important as that which will enable loaded ships to transport the products of the soil of the West from thence to the tide waters of the Atlantic Ocean. Wishing you entire success in your enterprise, I am,

Your Ob't Servant,
Wm. F. Parrott,
Civil Engineer,
39 State Street.

Office of Bishop's Derrick and Elevator Co.,
161 Broadway, New York, Nov. 8th, 1865.

H. H. Day, Esq.:

Dear Sir,—I will allow you to use my Patent Roller Carriage for your Marine Railway at Niagara for one half of the economy over any other known system of moving heavy weights. And this amount I would prefer to take in the stock of the Company, for I believe it to be the best enterprise undertaken in this State.

Yours truly,
A. D. Bishop, by A. T. Bishop.

New York, December 1st, 1865.

H. H. Day, Esq.,
23 Courtlandt Street, New York:

Dear Sir,—We have looked over your plan of passing ships up and down inclined planes as substitutes for canal locks, and can discover no engineering difficulty. The only questions are those of calculation, to construct the different parts of the proper strength. This can be made without difficulty by ordinary engineers.

The raising and lowering vessels from the water on to the plane can be accomplished with regularity, and, if required, in the space of ten minntes.

Yours, &c.,
Secor & Co.,
Dry Dock Builders.

Office of Michigan Central Railroad Co.,
Detroit, January 2, 1866.

Horace H. Day, Esq.:

Dear Sir,—Having seen your plan for a Marine Railway at Niagara Falls, and heard your explanations in regard to it, I am fully satisfied as to its entire practicability, and that there are no engineering difficulties which may not be readily overcome by means and appliances well understood and now in use.

But for its magnitude, it is probable no doubts could arise in any quarter as to the practicability of your plan. Should such doubts exist, I trust they may be speedily removed, and that your project may meet with the attention and success its importance entitles it to.

Very respectfully yours,

Jno. M. Berrian, *Civ. Eng.*

In 1864, the following named engineers were requested to examine the plan of a Marine Railway, which involved the idea of passing loaded vessels, floating in tanks or locks from one level to another, between navigable waters and their written opinions were uniformly favorable to the plan.

Edwin F. Johnson, Middletown, Conn.
William H. Talcott, *Chief Eng. Morris Canal*, Jersey City, N. J.
Daniel Marsh, Rochester, N. Y.
Gen. Charles B. Stuart, New York.
T. B. Blackstone, Chicago, Ill.
Charles S. Boggs, U. S. N.
Edward W. Serrell, New York City.
John Houston, *Engineer Erie R. R.*, New York.
S. Seymour, *Consulting Engineer U. P. R. R.*, New York.
W. W. Evans, *Civil Engineer*, New York.
Sam'l McElroy, *Civil Engineer*, Brooklyn, N. Y.
Wm. W. W. Wood, *Chf. Eng.* U. *S. N.*, *Gen'l Inspector*, New York.

Board of Trade Rooms,
Milwaukee, January 10, 1866.

The undersigned, a Committee on the part of the Chamber of Commerce, of the city of Milwaukee, make the following report:

That they have heard, with great interest and satisfaction, the statements and explanations of Mr. Horace H. Day, of New York, in relation to his plan of cheapening and expediting the transit of merchandise and the products of the soil between the East and the West, or more especially between Lake Erie and the Hudson River, by means of a Ship Canal, the ascent and descent on which shall be overcome by Inclined Planes of sufficient capacity to float the largest vessels which navigate our Lakes, thus obviating the necessity of transhipment, and of the delay and expense attending the same.

The Committee would say, that while they do not feel entirely competent to give an opinion as to the best mode of overcoming the elevations upon the route, they still feel fully satisfied, from their own knowledge of the subject, and from the opinion of competent engineers, which have been exhibited to them, of giving it as their opinion that Mr. Day's plan of Inclined Planes is perfectly feasible; and that in the important consideration of saving time, it has decidedly the advantage over locks.

The Committee do not, however, think that the best mechanical mode of constructing this important work is the question that they are mainly invited by Mr. Day to express an opinion upon; because this question, while it is of great practical importance, can and will be determined by competent engineers before the work shall have been commenced.

The vital question is: Does the business of this great and growing country require this additional communication? We say, most emphatically, it does. We also say that the time has now arrived when this great national highway cannot longer be delayed without great injury resulting to the growth and prosperity of both the East and the West; and we also pledge our hearty co-operation to the plan that shall be deemed most desirable to bring about this grand result.

In conclusion, the Committee would tender the thanks of the Chamber of Commerce of the city of Milwaukee, to Mr. Day for the exceedingly able and interesting manner in which he has presented the subject of this great National highway to their consideration, and to that of the public generally.

Edward H. Brodhead,
Alex. Mitchell,
Angus Smith,
John Nazro,
G. D. Norris,
I. A. Lapham,
} *Committee.*

The Vice-President then introduced the following resolutions, which were unanimously adopted:

Resolved, That a Committee of three members from this Board be appointed to confer with the Committees from other Boards of Trade in furtherance of the great object contemplated.

Resolved, That said Committee be instructed also to consider and report upon the question of the appointment of an agent of this Board, to be sent to Washington, to urge upon the Government the necessity of the immediate enlargement of the means of transit from the great West to the sea-board.

The President appointed Edward D. Holton, John Nazro and G. D. Norris, a Committee to carry out the purpose of the foregoing resolutions.

Detroit, Mich., Febuary 14, 1866.

Horace H. Day, Esq.:

Dear Sir,—I have examined your proposed method for raising and lowering vessels over inclined planes as a substitute for lockage.

Your plan, as I understand it, consists simply of the application of well known and long tried mechanical devices, on a larger scale than usual, for the accomplishment of certain ends in a new way, although the elements of your plan already exist in different form, and even greater magnitude, in engineering works. In the Niagara Suspension Bridge we have an example of cables much larger in size than your plan requires—and if transformed into one of sufficient dimensions would be ample for your use, while the anchorage necessary to resist the tension will be no more than one-tenth that given the suspending cables of this bridge. Iron hulls of ships are constructed possessing greater strength than required by your basin.

But your invention will meet with opposition, as all great inventions must. This, however, is but an argument in its favor. I believe in the entire practicability of your plan, after the application of an ordinary amount of engineering skill in designing and executing the works. Wishing your enterprise all the success its importance demands,

I remain yours, obediently,

S. W. Robinson,

Civil Engineer.

Leggett House,
New York, March 16, 1866.

Horace H. Day, Esq.:

Dear Sir,—I have attentively examined your proposed system for elevating water crafts from lower to higher planes, (such as the Lakes Ontario and Erie,) and have much pleasure in saying that it is entirely practicable. Much

greater and more expensive works of engineering have been accomplished, and are now in successful use, even where the pecuniary prospects were more doubtful than in this instance. It is but a few days since I saw four men moving a granite rock steadily up a plane of greater acclivity, weighing sixty-five tons—that rock, hewn from the mountains in Maine, and at that moment walking up the hill-side in the President's grounds at Washington, to take its place in company with several others of like dimensions on one of the porticos of the National Treasury. This was done by a sort of compound capstan or windlass power.

Either of the methods you present may be put into use—and I shall not, therefore, discuss their special merits. One of these, or some other better method, if one exist, should at once be adopted for the rapid transit of the commerce of the West to the plane of the Atlantic. That it will shortly be done, by some one or more methods, I have that faith which rests upon my study and confidence in the omnipotence of mechanical power, and the genius, enterprise and unlimited resources of the American people.

I have more than one method in my own study, differing wholly from yours, two of which I am confident are practicable—one probably, and the other certainly of vastly superior advantages. I had the pleasure, in conversation with you, to suggest the basis of the former, which you were so kind as to offer to give all the weight and consideration it merits. It will cost some elaboration to give it definite form. Of course you will remember it as mine, and not to be used or made public without my consent.

The other, and by all difference the best method I have yet considered, has been developed in my reflections since I saw you. Its advantages are such that I believe it must be adopted, and would assert itself, even if any of the others, my own included, were half constructed.

As these spring from my own thoughts and studies, they are my professional capital, and not to be lightly "cast upon the waters."

I have the honor to remain,

Very respectfully yours,

CALEB G. FORSHAY,

Civil Engineer,

Of Galveston, Texas.

NEW YORK, March 4th, 1866.

HORACE H. DAY, Esq.,

New York:

Dear Sir,—I have examined your plan for passing ships from the waters of Lake Ontario to the waters of Lake Erie by inclined planes and open canal. I consider the plan one that can be carried out with success. It will require skill and care and mechanical instinct to arrange all the parts to insure certainty and safety. I am fully convinced that ships of the largest size can be passed from around the Falls of the Niagara by a Canal or by a Railway, or

by a Railway and Canal combined; also, that the commerce of this couutry requires something of this kind, at the earliest possible moment, for the benefit of the East as well as the West.

Yours, sincerely

W. W. Evans.

Civil Engineer.

Boiler Experiment Department,
Brooklyn Navy Yard.
March 9th, 1866.

Horace H. Day, Esq.:

Dear Sir,—Having had your plan for a "great National highway" under consideration for sometime, we are fully impressed with the important advantages which will follow from its adoption. You propose to connect Lakes Erie and Ontario by means of a double inclined plane, having ten lines of stationary rollers to each tray, placed at suitable distances apart, for supporting vessels of 1,200 tons burthen.

These vessels will be conveyed up and down in water caissons, with tracks on the under side, working on the rollers. While one vessel ascends another descends, so that power as well as time are economized.

You also embrace in your plan the construction of a Ship Canal, from Lake Ontario to the Hudson River, either from Oswego or by a more northerly route, as may be decided by surveys under competent engineers. You will make use of similar inclined planes for overcoming the different levels in this canal, and make provisions for the same tonnage of vessels.

The present system of transportation, now in use on the Erie Canal, must always be inadequate to the increasing demands of trade between the East and West. Improvements to it may be made from time to time, but there inevitably remains a positive limit to the amount of tonnage which can be transported in a given time. But there are other points which no less claim our attention! We refer to the present methods employed—such as the kind of vessels and the use of locks, which require, at intermediate higher levels in the canal, a number of feeders from large and unfailing supplies of water. In placing your system side by side with this, we find, in place of these slow and limited methods, a combination of the best developed mechanical means, whether it be in the construction of the vessels to do service or the substitution of the inclined plane for the ordinary canal lock, by which you secure the most economical, speedy and prompt transit of freight.

We take pleasure in recommending this great National enterprise, and are satisfied, that in the first cost and in the running expenses, there will be a great saving of time and money over any other plan, and we believe that it is

the only true and practicable system for meeting the constantly increasing demands of trade at the North.

Yours, very respectfully,

W. H. Plumb, C. E.,
Clark Fisher, C. E.,
1st Asst. Engr. U. S. N.
C. C. Martin, C. E.,

Latonia, Venango Co., Pa., January 26, 1866.

Horace H. Day, Esq..
New York City:

Sir,—I regard your project of transferring vessels of larger capacity than any which have hitherto been attempted in inland navigation as practicable. We have first the weight of the vessel and her cargo, together with the weight of the apparatus upon which it must rest, and the friction, then the length of the plane and its inclination, and such appliances as the present condition of the manufacturing arts furnish, to enable us to overcome these and draw the apparatus, with its load, up the plane. It is, therefore, simply a problem in Dynamics, and the mechanical engineer may determine what is the practicable limit of capacity of the vessel which can, within reasonable time and expense, be moved from one level to another.

There can be but little doubt that satisfactory deductions would result from an investigation of this kind.

The practicable limit will, I judge, be governed by the maximum size of wire-rope which can be brought into use. I would, therefore, suggest that the plane be lengthened to the flats on the C. Hotchkiss' farm, and terminate there in an artificial basin, from which vessels may be locked to and from the river. There are other considerations also which favor this general plan. I am quite familiar with the route of this proposed improvement, and am aware of no serious engineering or mechanical difficulties to be encountered. It would, therefore, be possible, with due care in the preparation of plans, to estimate the actual cost of the work to within a small percentage.

As to changing vessels from one level to another without waste of lockage water, the idea is a valuable one; it would, in this particular instance, however, be of but little importance. But where a sufficient supply of water at the summit cannot be obtained, it would be of great consequence. And your idea, properly worked out in detail, may lead to results of very great moment.

I am, very respectfully,

Thomas M. Griffith.

The following opinion, written after six weeks' examination and reflection, is from a gentleman well known and extensively employed by the great capitalists of to day, and who is reported as "the most eminent mechanical engineer in the country."

It will be noticed that the declaration of Mr. Smith suggests entirely different, and, perhaps, even better methods than I have presented. The language of his opinion is emphatic, and leaves not a doubt of the entire success of this great work.

H. H. D.

HORACE H. DAY, Esq.,
23 Cortlandt Street,
New York:

Dear Sir,—I have carefully considered your scheme for a Ship Canal, with inclined planes, for the transfer of vessels around the Falls of Niagara, and have no hesitation in saying that I consider it perfectly practicable.

The elevation of the caisson, containing the vessel, from the canal on to the inclined planes, and its immersion again at the terminus, can be done by three different methods. The conveyance of the caisson over the railway of the inclined planes can be performed by two different methods.

In the present state of the mechanic arts there would be no insurmountable difficulty presented.

The constant flotation of the vessel in the caisson during its transit, and the means of overcoming great changes of level, without exhausting large bodies water in filling aud supplying locks, gives your plan, for some localities, very important advantages.

The great dispatch with which vessels can be transported past the Falls by the employment of inclined planes, compared with locks, is so manifest that it must receive the decided preference of the commercial community.

Respectfully yours,

ERASTUS W. SMITH,
Civil and Mechanical Engineer.

New York, March 19, 1866.

Genl. McReynolds, of Grand Rapids, Michigan, whose sacrifices and labors for his country in the field during the late Rebellion, and in Mexico under Scott, and whose large acquaintance with the West is so well known, closes his letter, December 31, 1865, *as follows:*

"I shall take much pleasure in rendering you any aid in my power to-
" wards the success of a project that, in my opinion, must revolutionize the
" whole commercial fabric of our country, rendering transcendant benefits to
" the great West reciprocal with that of the North and East, and illustrating
" in itself the genius and the capacity of the great American Republic.

" Your obedient servant,

" And'w T. McReynolds."

Office of Covington & Cincinnati Bridge Co.,
April, 1866.

H. H. Day, Esq.:

Dear Sir,—The plan you advocate for passing vessels around Niagara Falls is, in its *general* features, and without considering any details at present, sound and practicable. The transit of vessels by means of inclined planes is no longer an experiment; the eminent success of the inclines on the Morris Canal has settled this question. This Canal would be a total failure with locks; not only for the want of water, but also on account of the time consumed in passing the locks. Its success is owing to planes as a substitute for locks. The same plan has since been adopted and successfully carried out on one of the Canals in the eastern part of the Kingdom of Prussia—the Morris Canal inclines serving as models.

In thus pointing to the Morris Canal inclines as a success, I do not mean to be understood as endorsing all its machinery and details as the proper plan to be adopted for working the incline which is to overcome the descent of Lake Erie into Lake Ontario. Far from it. While the principle of inclines, as a substitute for locks, has been quite successfully carried out on the Morris Canal, it would be folly to presume that precisely the same thing would answer equally well for the Niagara Ship Canal.

This work is to pass all kinds of lake craft, from the smallest schooner to the largest steam propeller. A depth of water of 14 feet is to be insured, and vessels of 1,500 tons must be provided for. The whole transit, therefore, is to be on a large scale, and the saving of time in this transit is to be considered as of the very first importance. In fact, this contemplated national highway must be executed on a scale which will prove fully commensurate to the vastness of the country, whose traffic, between the East and West, is to be accommodated, not only for the present, but for all time to come. I say deliberately for all time to come; not, however, that the inclines and its machinery should be constructed *now* upon a scale and efficiency which would prove ample for all the commerce that may be expected in 100 years hence, but the works should be planned so that they may be extended and multiplied at any time without stopping the transit or tearing down again what has already been built up. The Canal itself, consequently, must be built of such dimensions as will prove ample for the future. One single inclined plane may answer for the present, but it must be so located and constructed that other inclines may be put up equally accessible to the main Canal. The doubling of locks is sometimes a difficult matter, but the doubling, trebling, or quadrupling of inclines can present no difficulty if the first location has been made with that view.

Two different modes of passing vessels over inclines present themselves, and both modes have been practically tested. The one method is the one adopted for the working of the Morris Canal inclines. There the vessels are lodged upon a dry cradle and thus passed over the plane. The same method was also pursued on the old Pennsylvania Canal, in overcoming the Alleghany Mountains by the inclines of the old Portage Railroad, which has since been

abandoned. The other plan is to float the vessel into a caisson or floating cradle, which, like the dry cradle, it to be mounted upon trucks, or, as you propose, to be conveyed over a series of stationary rollers. The latter plan involves greater weight and more expense, but has the merit of avoiding all strains upon the vessel, because it never leaves its element, but is kept afloat during the whole transit.

Another advantage of the water cradle or caisson is, that the two tracks (or series of tracks), which form *one* incline, are always kept in equilibrium or nearly so, because the caissons are kept evenly full of water, and it makes no difference whether vessels are floated in or not. The application of power, however, will be absolutely necessary for the purpose of controlling the motion of the caissons, and this power, of course, will be supplied by the abundance of water-power which the Canal itself furnishes.

The inclination of the plane being 1 in 40, the power to overcome the force of gravity will be very nearly in the same ratio. Suppose the caisson, filled with water, to weigh 2,000 tons gross, its resistance due to gravity will be—

2,000 ÷ 40 = ...	50 tons.
Allow for friction	10 "
Total strain upon ropes . .	60 "

Allowing for moderate speed 5 times this strength, an ultimate strength of rope equal to 300 tons will be needed. Employing the *best* of steel wire, such rope will have 3 square inches of solid section, and will weigh 10 lbs. per foot lineal. It may be advisable to use two ropes in place of one. On the Morris Canal inclines, which are very steep, iron wire ropes are used weighing from 7 to 10 lbs. per foot.

For the present, the details of the plans, which eventually may be adopted, should be left open questions. It is only important to know that the principles involved in the plan you advocate are sound and tried by experience.

The day is not far distant when a Ship Canal of the largest capacity will be demanded by the ever increasing commerce of that vast belt of grain growing country which stretches from the Atlantic to the Pacific, across the whole continent; a Canal that will form a direct water communication between Lake Ontario and the Hudson River. There is only one direct route for this Canal, and this is the Oswego line along the old Canal; and it may be added in this connection, that such a Canal, like the Morris Canal, can only be made successful by means of inclined planes.

The construction of the Niagara Ship Canal incline will, therefore, be only the first link of a series of improvements, which, in the nature of things, will be demanded by the necessities of that vast belt of country which is destined to control the future commercial relations of the whole continent.

Respectfully and truly yours,

John A. Roebling,

Civil Engineer.

SKETCH TO ILLUSTRATE TWO OF THE PLANS,
FOR CONSTRUCTION OF
DAY'S SYSTEM OF CANALS
WITH
INCLINED PLANES & MOVEABLE LOCKS.

T. BONAR, LITH. 124 NASSAU ST. N. Y.

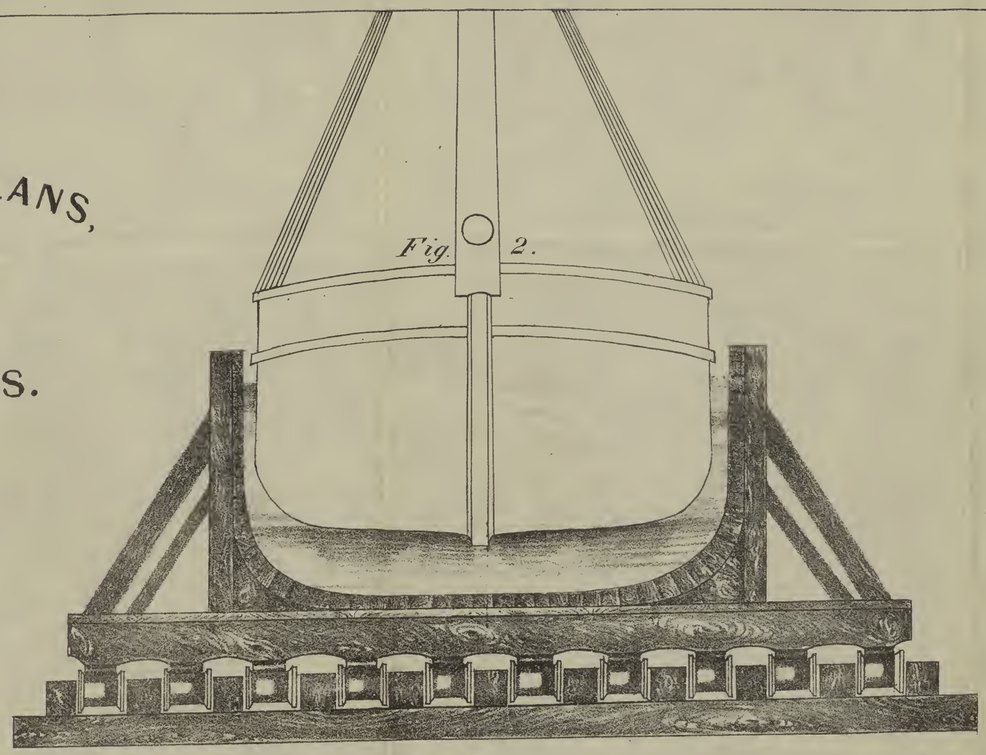
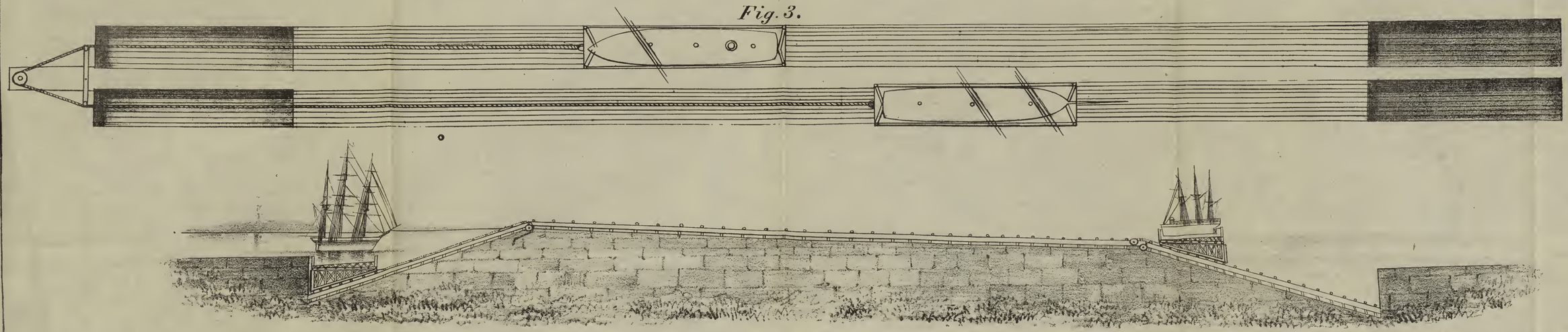


Fig. 2.

Fig. 1.

Fig. 3.



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